

AD \_\_\_\_\_

CONTRACT NUMBER DAMD17-97-C-7004

TITLE: Adaptation of Core-M's Electronic Sensory Platform for Monitoring and Control of Physiological and Non-Physiological Devices Employed on the Life Support for Trauma and Transport

PRINCIPAL INVESTIGATOR: Faith Guler

CONTRACTING ORGANIZATION: CORE-M, Incorporated  
West Newton, Massachusetts 02165

REPORT DATE: March 1998

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command  
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for public release;  
distribution unlimited

**DTIC QUALITY INSPECTED 2**

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

19980501 174

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 1998	3. REPORT TYPE AND DATES COVERED Annual (28 Oct 96 - 27 Oct 97)	
4. TITLE AND SUBTITLE Adaptation of Core-M's Electronic Sensory Platform for Monitoring and Control of Physiological and Non-Physiological Devices Employed on the Life Support for Trauma and Transport			5. FUNDING NUMBERS DAMD17-97-C-7004	
6. AUTHOR(S) Guler, Faith				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) CORE-M, Incorporated West Newton, Massachusetts 02165			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  Core-M has undertaken to design, develop and produce proof of concept models of control and data acquisition system for the LSTAT sled. The architecture for such a system is based on Core-M's unique modular electronic units that are individually programmable for any desired application. Each module has its own microcontroller and memory buffer area to assure real time acquisition and processing of the data collected. The units communicate with each other through I2C protocol, which requires only two wires. This unique approach makes it possible to realize low weight, low power, easy to implement system for LSTAT sled project.				
14. SUBJECT TERMS Life Support, Trauma, Transport			15. NUMBER OF PAGES 7	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

## FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army

( ) Where copyrighted material is quoted, permission has been obtained to use such material.

( ) Where material from documents designated for limited distribution is quoted, permission has been obtained to use the material.

*fs* (x) Citations of commercial organizations and trade names in this report do not constitute an official Department of the Army endorsement or approval of the products or services of these organizations.

( ) In conducting research using animals, the investigator(s) adhered to the "Guide for the Care and Use of Laboratory Animals", prepared by the Committee on Care and Use of Laboratory Animals of the Institute of Laboratory Animal Resources, National Research Council (NIH Publication No. 86-23, Revised 1985).

( ) For the protection of human subjects, the investigator(s) have adhered to policies of applicable Federal law 32 CFR 219 and 45 CFR 46.

( ) In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institutes of Health.

  
Principal Investigator's Signature

3/23/98  
Date

## TABLE OF CONTENTS

### **1.0 INTRODUCTION**

### **2.0 WORK PROGRESS**

2.1 High Speed I2C

2.2 Medium Speed I2C

2.3 High Capacity Mass Storage Module

2.4 Real Time Clock

2.5 User I/O

### **3.0 CONCLUSION**

## **1.0 INTRODUCTION**

On October 28, 1996 Core-M received a contract from the US Army Department of Medical Research to design, develop and produce proof of concept models of an LSTAT electronic modular control system which is lightweight and has low energy requirements. Said control system is to be based upon Core-M's previously developed hardware/firmware architecture. Under this system the physiological and environmental parameters on LSTAT sled are collected under real time clock calendar where this critical information is relayed to the user through a rugged LCD display. Next to display is a keypad provided for convenient user input. All data collection and information distribution is accomplished through I2C, which requires only two wires. The data acquisition is accomplished by individual units, which have their own micro controllers and memory buffer areas. Core-M's this approach in gathering data and distributing command assures the most reliable, lightweight, low-powered configuration.

## **2.0 WORK PROGRESS**

During the end of 1996, the first quarter of 1997 and the first quarter of 1998 the LSTAT design team has finalized the design and prototyping of all the core modules that are essential to the system. These are "High Speed I2C" communications module, "Medium Speed I2C" communications module, "High Capacity Electronic Mass Storage" module, and "Precision Real Time Clock Calendar" module. The design team also finalized the design of "User I/O" module with LCD display and keypad.

The following is a summary of the status of each of the above listed modules:

### **2.1 High Speed I2C**

The High Speed I2C communications module is responsible for moving command and data to other modules at the rate of 1.0 MHz and higher. This module converts wide ranges of communications protocols to I2C and is used as an interface between other units such as the ones that have only RS-232 communications capability. The modules have their own micro controllers and memory storage sections that buffer the incoming data. The design of this module is finalized. The prototype is implemented and the core software algorithms are created for high-speed data transfers.

## **2.2 Medium Speed I2C**

The Medium Speed I2C communications module establishes command and data transfers between sensory modules and the master control unit. Similar to the High-Speed communications module, this module converts different communications protocols to I2C and is used as an interface between other units. The modules have their own micro controllers and memory storage sections that buffer the incoming data. The speed of this module is 400 kHz. The design of this module is finalized. The prototype is implemented and the core software algorithms are created.

## **2.3 High Capacity Mass Storage Module**

The Mass Storage module stores the entire system status and data in 40 Mbytes rewritable flash memory banks. The module communicates directly with the master control unit on parallel data bus. The design of this module is finalized. The prototype is implemented with a smaller capacity version and the core software algorithms are created.

## **2.4 Real Time Clock**

The Precision Real Time Clock Calendar and the Real Time Clock Calendar modules are designed and implemented as an integral part of communications modules. This method assures the best timing precision on the real time events as they are gathered and buffered independent of the master control unit by the communications modules. These units are responsible for synchronizing and tracking the real time clock and calendar information on the events and data that is stored in the Mass Storage module.

## **2.5 User I/O**

The User I/O module establishes the user interface with the whole system. It contains a custom LCD display with touch screen capability, and membrane key switches for information display and user input. The design of custom LCD together with its electronics and membrane key switch is finalized and submitted to the LCD vendor for manufacturing of prototypes. However, at this juncture due to the complexity of the display information segments, the long lead times for the manufacturing of prototype units and exorbitant NRE fees (non recurring engineering fees) has forced us to redesign the user I/O employing an off the shelf high performance LCD module. Said redesign has been completed.

### **3.0 CONCLUSION**

In addition to the completed tasks to date, the design/development team has commenced work on the following tasks, which are yet to be completed:

- 3.1** Selection and implementation of new micro controller for use in the master control unit. Among various new generation micro controllers, the design team has evaluated a wide range of products. These include Philips 8051 XA, Intel 80251, Intel 80151, Intel 80296, Motorola 68HC12, and Motorola 68HC16. Motorola 68HC16 is selected as the micro controller for the master control unit. At this juncture, the design team is yet to fully deploy/implement its micro controller selection.
- 3.2** Interface with other on board devices: no significant progress has been made to date on this front with the exception of protocol format definition. Design and implementation of environmental sensory modules the sensory input module has been developed, however no sensory integration has been fully completed at this juncture.
- 3.3** Prototype production of the various modules is yet to be realized.
- 3.4** The analog modules that interface between physiological sensors and the system are ready. The interface and control of these units is to be realized.
- 3.5** Prototyping and software for the user I/O module with LCD and keypad needs to be done.
- 3.6** Mechanical enclosures and cabling connections and harnesses has to be worked out.
- 3.7** System integration and validation: said effort has yet to be tackled.